

G. R. McLACHLAN, R. LIVER-
SIDGE and R. M. TIETZ
PORT ELIZABETH MUSEUM

A record of *Beradius arnouxii*
from the South-East Coast of
South Africa

ABSTRACT

The occurrence of *Beradius arnouxii* in South African waters is recorded and descriptions of external features and cranial characters are given. Body and skull proportions are compared with those of other specimens of *B. arnouxii* and also with those of *B. bairdi*. These comparisons show that the two species resemble one another closely and that the main ground for their separation is the great distance between their distribution areas; *B. arnouxii* being restricted to Southern seas while *B. bairdi* has a northern distribution.

INTRODUCTION

In Professor Flower's account of the recent Ziphioid Whales (1874) he points out that "Their very presence in the Ocean seems to pass unnoticed and unsuspected by voyagers, and even by those whose special occupation is to capture the various better known cetaceans, until an accidental occurrence reveals the existence of forms of animal life of considerable magnitude and at least sufficiently numerous to maintain the continuity of the race". In spite of subsequent strandings of Beaked whales in various and distant parts of the world resulting in the descriptions of more genera and species of the Ziphiidae these words hold true today for although we know more about the taxonomy and the skeletal structure of the Beaked Whales, our knowledge of their distribution is incomplete and their habits are almost entirely unknown.

Occasionally members of this group are found stranded on the shores of Southern Africa and the Port Elizabeth Museum has been extremely fortunate in acquiring records of all the genera represented in South African Waters. In February, 1907 a specimen of *Mesoplodon layardi* was washed up at the mouth of the Zwartkops river while 3 years later in April, 1910 *Mesoplodon grayi* was found stranded near Cape Recife. We hold two records for *Mesoplodon densirostris*: one from Cape Recife in April, 1952 and one from Jeffery's Bay in January, 1953. We are now pleased to report the addition of another genus to our list, a first record for Southern Africa. It is interesting to note in passing that all strandings of Beaked Whales on South African Shores have taken place during the warmer summer months (personal communication with Peter Best of S. A. Museum) with the exception of a specimen of *Mesoplodon mirus* which was

stranded in May, 1959 at the Wilderness (Talbot 1960).

On the 31st December, 1962 Mr. D. Taylor reported the stranding of a "Porpoise Whale" two miles west of the Kromme River Mouth, Jeffery's Bay. On New Year's Day Dr. G.R. McLachlan and Mr. R. Liversidge of the Port Elizabeth Museum travelled out to inspect, measure and identify the specimen and to secure the skull and Mandible for the Museum.

EXTERNAL FEATURES

The whale was an adult male 30'6" in length and was reported to be wholly black in colour. It was assumed that this animal had not been dead more than two to three days and that the extreme darkness of colour had developed after death as we have observed with other cetacean strandings.

The head bore a prominent forehead and the lower jaw projected approximately 3" beyond the snout. Only two large teeth were visible in the mandible at its distal end and of these the crown of the right one was badly chipped. Unfortunately the skin and flesh of the throat had been cut away so that the throat grooves so characteristic of the Ziphiidae were not discernable. Apart from this gash there was no external wound but the skin was lacerated and there were a few blisters. The flukes with a span of 8'6", did not show a median notch, a feature common to the Ziphiidae but there was a slight indentation medially. The flipper was about $\frac{1}{4}$ of the body length while the dorsal fin was most insignificant being only about 5 $\frac{3}{4}$ " high and without the concave emargination posteriorly as in other Cetaceans. Table 1 shows the external measurements and their percentage of total length of the specimen as compared with the same figures for a 29' adult female *Berardius arnouxii* stranded on the coast of South Australia (Hale, 1962).

TABLE 1
BODY PROPORTIONS OF *BERARDIUS ARNOUXII*

	male		female	
	mm	%	mm	%
Total length	9296	100	8845	100
Tip of snout to vertical level of anterior corner of eye	914	9.83	915	10.3
Tip of snout to blowhole	1143	12.3	1040	11.7
Tip of mandible to vertical level of anterior corner of eye	990	10.6	864	9.7
Projection of lower jaw beyond tip of snout	76	0.82	51	0.5
Tip of snout to vertical level of anterior end of base of dorsal fin	5892	63.37	5871	66.3
Tip of snout to axilla	1727	18.57	1982	22.4
Length pectoral flipper (axilla-tip)	736	7.91	787	8.9
Width of flukes	2590	27.86	2238	25.3
Height of dorsal fin	149	1.6	153	1.7

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The measurements and body proportions of the 2 specimens are comparable justifying the identification of the South African Specimen as *Berardius arnouxii*. Further the dimensions shown here shed no light on possible sexual dimorphism in this species. Among the Ziphioid Whales the male is usually the larger and in this case the adult male is only slightly larger than the adult female discrediting the statement of Slipp and Wilke (1953) that the usual Ziphiid size relationship between the sexes is apparently reversed in *Berardius*.

The relative size of the South African specimen as compared with the smaller *Hyperoodon* and *Mesoplodon*, the prominent melon, or forehead and the projecting lower jaw bearing teeth distally leave no doubt that it belongs to the genus *Berardius* Duvernoy 1851.

At present two species of *Berardius* are recognised in literature and as the two resemble one another very closely the distinction seems to be based on their distribution alone. The Genotype, *Berardius arnouxii* shows a Southern distribution having been taken from New Zealand (Flower 1874), South America (Marelli, 1920) and South Australia (Hale 1939) while *Berardius bairdi* has been recorded from the North Pacific; Behring Island, St. George Island, California (True 1910), Japan (Omura, Fujino & Kimura, 1955) as well as from the North Atlantic at Ocean City (Slipp & Wilke, 1953).

Records show that *Berardius bairdi* is consistently the larger species: a 42' female from St. George Island, Alaska (True 1910) a 34' female from Ocean City (Slipp & Wilke, 1953), a 33' male from British Colombia (Pike 1953) and a 36' female from Japan (Omura, Fujino and Kimura, 1955) while the specimens of *Berardius arnouxii* do not measure up to these lengths: a 27' specimen from New Zealand (True 1910), a 30'6" specimen from New Zealand (Flower 1874) and a 29' female from South Australia (Hale, 1939).

Both in its Southern distribution and in its size the 30'6" South African specimen falls within the limits for *Berardius arnouxii*. Hale (1962) quoting Omura Fujino and Kimura (1955) has suggested that this constant difference in size between the two species is a result of a fore-shortening of the caudal region due to smaller caudal vertebrae in *B. arnouxii*.

Other distinguishing features between the two species have been noted from time to time. True (1910) observed that in *B. bairdi* the flukes were wider, the pectoral flippers longer and the dorsal was higher. (Table 2) shows these proportions for 3 specimens of *B. bairdi* and three specimens of *B. arnouxii* indicates that, contrary to the opinion held by True (1910) and in accordance with Hale's (1962) conclusion the span of the flukes (being the measurement from tip to tip) in both species of *Berardius* is comparable. Further, the dorsal fin originally thought to be higher in *B. arnouxii* than in *B. bairdi* cannot be used as a criterion for though it is high in the New Zealand specimen it is considerably lower in both the South African and South Australian adults and seems to show tremendous variation.

Hale (1962) noted that the snout of the South Australian *Berardius* was relatively longer and that the lower jaw projected for a lesser distance as compared with these features in the female specimens of *Berardius bairdi* from Japan (Omura et al 1955). The proportions of the projection of lower jaw beyond the snout are 0.5% and 0.8% of the body length for the South African specimen and South Australian specimen respectively. These proportions fall within the range 0.3% and 1.0% given by Pike (1953) for two specimens of *B. bairdi* from British Colombia. So the possibility of this proportion as a distinguishing feature falls away.

TABLE 2

PROPOSED BODY PROPORTIONS AS DISTINGUISHING FEATURES
FOR *BERARDIUS* Spp.

	<i>B. bairdi</i>			<i>B. arnouxii</i>		
	British Colombia	St. George Island	St. George Island	New Zea- land	South Aus- tralia	South Africa
	(Pike)	(True)	(True)	(Hector)	(Hale)	
Sex and maturity	adult male	adult male	juvenile male	male	adult female	adult male
Total length	33'33"	40'2"	25'5"	27'6"	29'	30'6"
	%	%	%	%	%	%
Length pectoral flipper	13.0	12.4	13.4	9.4	8.9	7.9
Span of flukes ...	28.6	25.3	24.6	19.1	25.3	27.86
Hight dorsal fin .	2.3	2.5	2.4	3.0	1.7	1.6

From Table 2 it can be seen that the only external feature on which one could possibly separate the two species of *Berardius* (bar their relative size) is the pectoral flipper which appears to be longer in *B. bairdi* than in *B. arnouxii*. Yet Hale (1962) states the flippers of the South Australian specimen are fully as long and as wide as those of female *B. bairdi* recorded from Japan by Omura et al (1955) though he does not quote the measurements.

We may assume then that on external features alone, there is little ground for the separation of the two forms of *Berardius* as full species.

THE SKULL

The Skull and mandible were buried in dry sand high up on the shore and 9 months later were recovered for the museum. By this time meat and blubber had rotted away leaving the bones clear but unfortunately curio-hunters had made off

with teeth from the left mandible.

The skull of *Berardius* differs from those of the other members of the Ziphiidae in that the premaxillae are proximally symmetrical and do not form a canopy over the external nares as in *Mesoplodon* and *Hyperoodon*. The vertex of the skull is moderately elevated and is formed not so much by the premaxillae as by the nasals which are substantial in this genus. Further, proximal ends of the

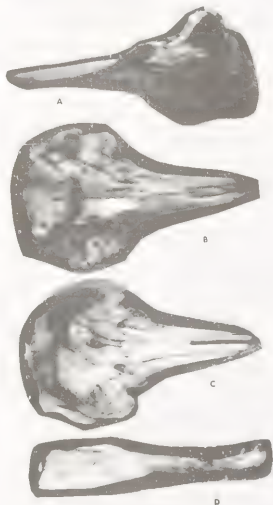


Plate 1

Skull of *Berardius arnouxii*

A. Lateral view, B. Ventral view, C. Dorsal view
and D. Lateral view of lower left mandible with
laterally compressed teeth.

premaxillae are not rugose or pitted as in *Hyperoodon*. In these and other features the skull of the South African specimen corresponds closely with descriptions (Flower 1874) of the skull of *Berardius arnouxii* with the exception that the mesethmoid is ossified for almost half the length of the rostrum while the description of the type reveals that the mesethmoid is only partially ossified. In this respect the South African specimen resembles the South Australian *Berardius arnouxii* and Hale (1962) states that the increase in ossification is probably due to the advanced age of the animal. (See Plate 1).

Once the flesh had rotted away from the mandible two teeth were revealed on either side of the mandibular symphysis. The teeth which are directed forward are conical and laterally compressed. The anterior being twice as large as the posterior. Both teeth are similar in structure; (See Plates 1 & 2) a small cone of dentine surrounded by a mass of cement which is almost completely covered by the alveolus of the bone and in the smaller posterior tooth by bone and gum. In accordance with Flower's (1874) description the pulp cavity is completely closed and the base rugose. Embedded in the alveolus of the anterior right-hand tooth were nodules of cement that had become separated from the tooth. Table 3 shows measurements of the skull of the South African specimen.

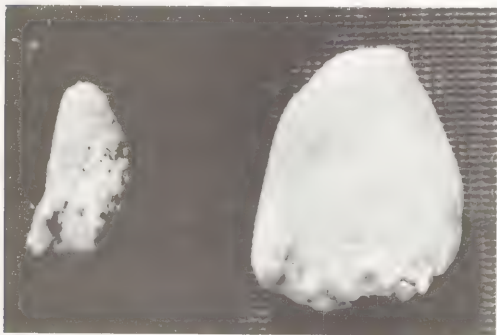


Plate 2
Laterally compressed teeth from lower jaw of *Berardius arnouxii*.

TABLE 3

MEASUREMENTS OF THE SKULL OF *BERADIUS ARNOUXI* FROM
SOUTH AFRICA P.E.M. 1496/67

Total length (Condylø-basal)	1262 mm
Vertex to inferior border of pterygoids	521 mm
Breadth across middle of orbits	615 mm
Breadth across posterior orbital processes	700 mm
Breadth across zygomatic processes	704 mm
Length of rostrum (tip to perpendicular line joining the base of the maxillary notches	815 mm
Breadth of rostrum at base (measurement across the lone joining the bases of the maxillary notches	429 mm
Depth rostrum at middle	125 mm
Breadth rostrum at middle	202 mm
Length premaxillae	1075 mm
Breadth premaxillae at middle	111 mm
Greatest breadth premaxillae in front of nares	217 mm
behind nares	211 mm
Distance from anterior end of premaxillae to level of posterior border of pterygoids	1027 mm
Tip of rostrum to anterior border of vomer	674 mm
Length of vomer	205 mm
Length nasals	111 mm
Greatest breadth nasals	125 mm
Breadth of anterior nares	861 mm
Length nares (greatest median)	128 mm
Breadth across occipital condyls	1982 mm
Breadth across foramen magnum	805 mm
Breadth right condyl	71 mm
hight right condyl	151 mm
Length of temporal fossa	274 mm
Depth temporal fossa	116 mm
Length mandible	1170 mm
Symphysial length	243 mm
Tip of mandible to centre of first tooth	47 mm
Tip of jaw to centre of second tooth	128 mm
Height coronoid	215 mm
Least depth of mandible behind first tooth	102 mm

The question arises whether there are cranial characters which could be used to distinguish *B. arnouxi* from *B. bairdii*. A character used by True (1910) to distinguish between the two species is the relative size of the head which is

supposed to approximate $\frac{1}{4}$ of the total length in *B. bairdii* and $\frac{1}{4}$ of the total length in *B. arnouxii*. In both the South African specimen and the South Australian specimen this fraction approximates the range for *B. bairdii* more than *B. arnouxii* and Pike (1953) has shown that the fraction is variable for *B. bairdii* so that this character would be unreliable in the determination of species.

Table 4 shows a comparison of skull measurements of 4 specimens of *Berardius arnouxii* (A1 - A4) with 4 specimens of *Berardius bairdii* (B1 - B4) expressed as the percentage of the greatest breadth across the post orbital processes this being a more durable dimension as compared with condylobasal length as the rostrum can be broken off or altered by beach wear.

EXAMPLE SPECIMENS USED IN TABLE 4

- A 1. Genotype, *Berardius arnouxii* (Duvernoy 1851).
- A 2. 32' *Berardius arnouxii* (Flower 1874)
- A 3. 29' female from South Australia, (Hale 1962) (*B. arnouxii*)
- A 4. 30' 6" male from South Africa 1963 (*B. arnouxii*)
- B 1. 29' immature female from Vancouver Island, British Colombia, (Pike 1953) (*Berardius bairdii*)
- B 2. *Berardius bairdii* male from Vancouver Island 33' Pike 1953
- B 3. *Berardius bairdii* 36' female from Japan (Omura et al 1955)
- B 4. *Berardius bairdii* 34' adult (probably female) from Washington (Slipp & Wilke 1955).

Table 4 proves nothing conclusive about the comparative dimensions of the skulls of the two species of *Berardius* for in all the ranges are similar and many overlap and there seems to be nothing in this series of measurements one can point to as a distinguishing feature between the two species.

True (1910) lists characters of the bones of the skull *in situ* which differ in the two species. Firstly he maintains that the rostrum is less massive at its base in *B. bairdii* than in *B. arnouxii* but other authors have pointed out that this character varies considerably from specimen to specimen and should not be taken into account. Table 4 also shows that the proportion, breadth or rostrum at base has the same range in *arnouxii* as in *bairdii*.

In comparing the skull of the South African specimen with photographs of skulls of *B. bairdii* supplied by True (1910), the differing characters listed by True are not apparent and the skulls are similar, but one must bear in mind that photographs are compared and not a specimen. True has stated that in *B. arnouxii* the nasal bones have lateral extensions whereas in *B. bairdii* the nasal bones have straight sides. In this respect the skull of the South African specimen does conform with the pattern of nasal bones for *arnouxii*.

CONCLUSION

With the study of more and more specimens of the genus *Berardius* it

TABLE 4

	A 1	A 2	A 3	A 4	B 1	B 2	B 3	B 4
Total (condylobasal) length	186.1	200	180.0	180.3	203.8	187	196.8	181.8
Height from vertex to inferior border of pterygoids	66.0	77.7	92.5	74.4	79.7	73.9	79.1	73.6
Breadth across postorbital processes	100	100	100	100	100	100	100	100
Length of rostrum	119.5	134.0	109.2	115	132.0	117	127.6	116.7
Breadth of rostrum at base	55.3	58.2	65	61	60.2	58.1	60.5	56.3
Breadth of rostrum at middle	20	22.1	24	28	29.4	27.0	27.8	26.0
Length of premaxilla	-	-	155.0	153.5	180.9	158.4	191.1	162.6
Breadth of premaxilla at middle of length	12	13.3	17.4	15.9	20.9	17.1	15.7	15.7
Greatest breadth of premaxillae in front of nares	28	30.3	31.1	31	36.3	30.9	31.9	31.1
Greatest width of premaxillae behind nares	32	-	28.5	30.2	30.8	26.5	26.6	27.2
Distance from anterior end of premaxillae to level of posterior border of pterygoids	144.4	160.0	142.1	146.7	131.3	148.8	162.0	141.8
Length of nares (greatest median)	-	-	17.1	17.8	16.7	-	19.5	17.1
Breadth of nares (greatest)	13.6	10.78	14.0	12.3	19.6	12.7	15.9	16.6
Breadth across occipital condyles	28.4	27.84	31.4	28.31	32.8	31.9	33.0	27.9
Breadth condyle	-	-	13.5	10.1	15.2	14.9	15.1	13.9
Height condyle	-	-	22.0	21.5	26.3	23.4	22.6	21.6
Length of mandible (right)	165.2	181.5	165.0	167.1	180.6	173.2	180.1	-
Height at coronoid	29.7	30.8	32.8	30.7	32.2	31.3	32.4	28.2

becomes more and more apparent that the two species recognised, *B. arnoux* and *B. bairdi* are indistinguishable and one doubts the validity of *bairdi* as a species. There is a great distance between their distribution areas and it appears that in Northern seas the adult reaches a greater length. Such a character is indicative of a sub-specific relationship rather than specific.

AUTHORS' NOTE

The type *Berardius arnuxii* founded by Duvernoy in 1851 was named after Captain Bérard who attended the capture and M. Arnoux who supplied a brief description of this beaked whale. Later authors have referred to the animal as *B. arnouxii* (Flower 1874) *B. arnouxii* (Marelli 1920) *B. arnuxii* (True 1910) and *B. arnuxi* (Hale 1962). The present authors have chosen to adopt Professor Flower's spelling "Arnouxii" as being closest to the name from which it was derived.

ACKNOWLEDGEMENTS

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